NRC FORM 195 (2-76) — U.S. NUCLEAR REGULATORY COMMISSION

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DOCKET NUMBER: 50-220

FILE NUMBER:

TO: Mr. George Lear

FROM: Niagara Mohawk Power Corp. Syracuse, New York Mr. Rudolph R. Schneider

DATE OF DOCUMENT: 8/3/76

DATE RECEIVED: 8/6/76

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PROP

INPUT FORM

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DESCRIPTION

Ltr. w/attached...re their 5/19/76 ltr. and our 6/9/76 ltr....furnishing additional in information concerning Assembly Averaged Power-Void Relationship Tech Spec.

PLANT NAME: (5-P)

Nine Mile Point #1

ENCLOSURE

ACKNOWLEDGED

DO NOT REMOVE

SAFETY — FOR ACTION/INFORMATION — ENVIRO 8/6/76 RJL

	SAFETY			ENVIRO
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CONTROL NUMBER: 7918

NIAGARA MOHAWK POWER CORPORATION

NIAGARA MOHAWK

300 ERIE BOULEVARD WEST
SYRACUSE, N.Y. 13202

RECEIVED
AUG 6 1976
U.S. NUCLEAR REGULATORY COMMISSION
Mail Section

August 3, 1976

Director of Nuclear Reactor Regulation
Attn: Mr. George Lear, Chief
Operating Reactors Branch #3
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Nine Mile Point Unit 1
Docket No. 50-220
DPR-63

Dear Mr. Lear:

Our letter of May 19, 1976 transmitted proposed changes to the Assembly Averaged Power-Void Relationship Technical Specification for Nine Mile Point Unit 1. Your letter of June 9, 1976 requested additional information regarding that proposed change. The attached responses address the questions contained in your letter.

Sincerely,
NIAGARA MOHAWK POWER CORPORATION

Rudolph R. Schneider
Vice President - Electric Operations

DOCKETED
USNRC
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Attachment

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[illegible]

[illegible]

[illegible]

Request

Provide a quantitative explanation of how exposure dependent "B" values are calculated. Include examples which show how different values of "B" were calculated for two different exposures of the same fuel. The examples should show (1) the relationships (equations) assumed, and (2) the source and numerical values of all terms in the relationship for:

1. Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) and Average Heat Generation Rate ($\dot{q}$) (i.e., assumed peaking factors).

2. Dryout Time (i.e., h_g, h_{in}, flow, average density, $\dot{q}$).

3. "B" values (i.e., void fraction, peaking factor, power).

Response

The duration of nucleate boiling for non-jet pump plant ECCS analyses has been determined using the correlation (Equation 1, below) described in "General Electric Compliance with 10CFR50 Appendix K-Acceptance Criteria I.C.4." That correlation shows the time to boiling transition (dryout time) is a function exclusively of liquid volume fraction and power input to the bundle. Converged MAPLHGR limits and conservative axial power distributions were assumed for the dryout time determinations. Both MAPLHGR limits and dryout times are exposure dependent. The following development shows how "B" values are calculated.

$$\Delta t = \frac{(0.31)(\rho_f)(h_{fg})}{Q'''} \qquad \text{Equation 1}$$

Δt = time to transition boiling, hr.

ρ_f = saturated liquid density, lbm/ft^3

h_{fg} = enthalpy of vaporization, BTU/lbm

$$Q''' = \frac{\dot{q}}{V\,(1 - \alpha_i)}$$

$\dot{q}$ = Power generation in bundle, BTU/hr = (PF)(FCP)(ABTU)

PF = bundle radial power factor

FCP = fractional core power relative to 1850 MW

ABTU = average bundle output at 1850 MW, BTU/hr

V = active coolant volume, ft^3

α_i = void fraction

Therefore . . .

$$\Delta t = \frac{(0.31)(\rho_f)(h_{fg})(V)(1 - \alpha_i)}{(ABTU)\quad(PF)(FCP)} \qquad \text{Equation 2}$$

$$\text{"B" Factor} \equiv \frac{(1 - \alpha_i)}{(PF)(FCP)} \qquad \text{Equation 3}$$

Limiting this "B" factor relationship will assure that local power void values will not result in dryout times shorter than those used in the ECCS Analysis.

Using Equation 2:

$$\text{"B" Factor} = \frac{(ABTU)\ (\Delta t)}{(0.31)(\rho_f)(h_{fg})(V)} \qquad \text{Equation 4}$$

Assumed nominal values are:

ABTU = 1.1869×10^7 BTU/hr

ρ_f = 45.977 lbm/ft^3

h_{fg} = 641.36 BTU/lbm

V = 1.2696 ft^3, Initial Core

V = 1.2948 ft^3, Reloads 1, 2, 3

$V = 1.2936\ ft^3$, Reloads 4, 5

Substituting the above values in Equation 4 yields the "B" factor relationships for the different reloads:

"B" Factor	=	$(1022.688)(\Delta t)$	Initial Core	Equation 5
"B" Factor	=	$(1002.784)(\Delta t)$	Reloads 1, 2, 3	Equation 6
"B" Factor	=	$(1003.714)(\Delta t)$	Reloads 4, 5	Equation 7

The following examples show how different values of "B" were calculated for two different exposures of the same fuel (Reload 3):

Exposure	ECCS Analysis Dryout Times	MAPLHGR
5000 MWD/T	1.48 sec	10.68
25000 MWD/T	1.59 sec	9.92

Sunstituting the above dryout times in Equation 6 yields:

For 5000 MWD/T:

$$\text{"B" Factor} = (1002.784)(\Delta t)$$

$$\text{"B" Factor} = \frac{(1002.784/hr)\ (1.48\ sec)}{3600\ sec/hr}$$

$$\text{"B" Factor} = 0.412$$

For 25000 MWD/T:

$$\text{"B" Factor} = (1002.784)(\Delta t)$$

$$\text{"B" Factor} = \frac{(1002.784/hr)\ (1.59\ sec)}{3600\ sec/hr}$$

$$\text{"B" Factor} = 0.443$$

Request

Demonstrate how "B" values are calculated to assure conservatism when using the dryout times assumed in the ECCS analysis.

Response

As indicated in the above response, nominal values were used to calculate the "B" factors. Converged MAPLHGR limits and conservative axial power distributions were assumed for the dryout time determinations. In addition, a conservative correlation (G.E. compliance with 10CFR50, Appendix K criteria I.C.4.) was used which was previously approved by the Commission.

A "B" Factor Limiting Condition for Operation is not necessary to assure that actual dryout times are conservative. Dryout time is only one of many conservative inputs used to determine MAPLHGR limits, the ultimate restriction of interest. Sensitivity analyses performed by our fuel supplier have determined that the parameters used to calculate dryout time (void fraction, axial power distributions) are conservative when compared to normal plant operation.